APPLICATION GUIDE

AIR DISTRIBUTION DESIGN FOR IN AN INDOOR FIRING RANGE

There are over 16,000 firing ranges in the US, making them a surprisingly common structure. By the nature of the application, safety is critical, and it extends beyond that of the firearms. It includes the air distribution system, which must provide a safe atmosphere for both employees and patrons.

The average indoor firing range consists of a long rectangular space, where only a small section is occupied. This is known as the bay. The rest of the space is reserved for the tactical range and bullet trap, both of which are pre-specified distances or lengths. *(Figure 1)*

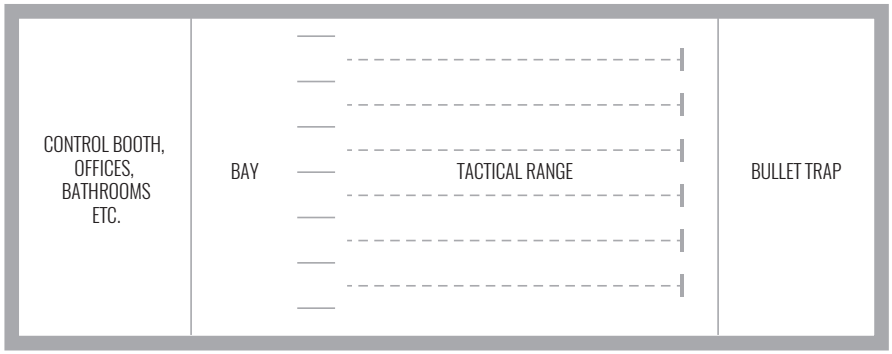

Figure 1: Typical Firing Range Layout

A major risk factor with this type of application is lead build-up. This is due to the constant discharge of lead dust particles within an enclosed space. Over time, it can become increasingly hazardous for occupants, which is why it is so important that these contaminants be forced away from the occupied area.

While contaminant control is a priority, occupant comfort must also be considered. According to ASHRAE 55 ADPI requirements, the temperature should be within a range (-3°F to +2°F) of the room setpoint and the air velocity should be less than 70 fpm. Following these guidelines will help ensure that over 80% of occupants in the space are comfortable and that productivity and efficiency are maximized.

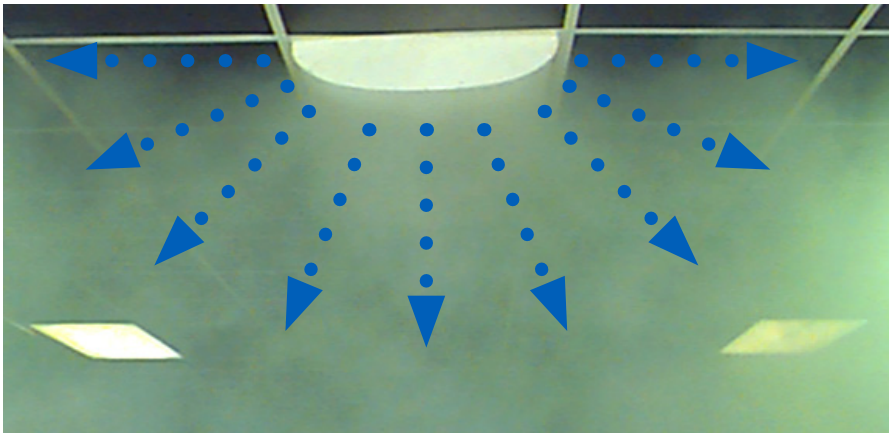

Figure 2: Radial Airflow Demonstration with Theatrical Smoke

In terms of supply air distribution design, the goal is to provide clean, comfortable air directly into the occupied zone and disperse contaminants away from the occupants with minimal disturbance to the bay or tactical range. While this can be achieved a few ways, we believe radial diffusers would be ideal. Not only are these products able to handle large volumes of air, but they are designed to minimize air speed while radially pushing contaminants in a uniform, outward motion**.** *(Figure 2)*

Krueger offers two radial flow products, the RadiaFlo and the TAD. While both diffusers provide a true 90° or 180° radial airflow pattern and have various material and filter options, they do have their differences. The RadiaFlo is a flush face design that is perfect for an application with limited space. The TAD has a patented drop face design, which allows it to perform exceptionally well, even with poor inlet conditions. *(Figure 3)*

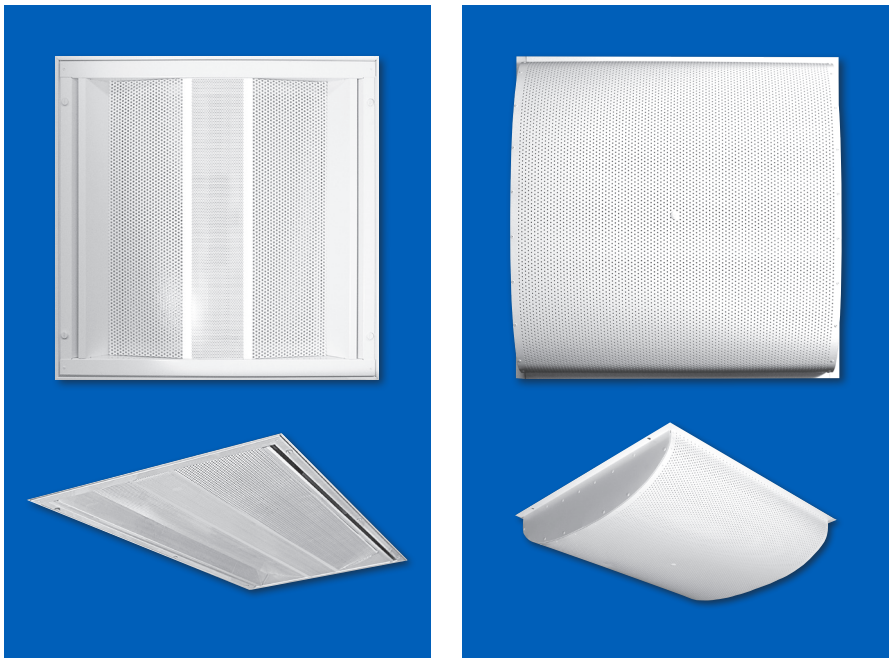

Figure 3: Face and Isometric Views of Krueger's RadiaFlo (left) and TAD (right).

To further illustrate the application, we have provided a few jobsite photos of TAD units, which were positioned at an angle in the back of the bay of a newly constructed firing range. *(Figure 4)*

In terms of exhausting air, the location and quantity of return devices are important. To properly remove airborne particulates and excess heat, return grilles must be placed across the tactical range in larger quantities to prevent lead build-up within the space and provide a safe area for employees to clean or perform maintenance. Exhaust fans are also recommended near the backstop of the tactical range to create negative pressure within the room by pulling the contaminated air further from the occupied zone. The addition of a filter frame and filter with the return grilles is also recommended to ensure any air that may be recirculated into the space is cleansed prior to reentry into the occupied zone. According to ASHRAE standard 52.2, lead dust requires a MERV 11 filter to properly ensure that lead particles are not penetrating through the filter back into the plenum space or ductwork.

Figure 4: TAD Installation Photos

Depending on the design requirements, Krueger offers several return grilles from which to choose, both in fixed blade styles, such as the S80, S580, S85, and S585 as well as in perforated styles, like the S80P and S580P. There are also options for stainless steel construction with the 9S80HF or heavy-duty construction with the S480 or S5480. Each of these models would work in a firing range application, so the selection would be more dependent upon the level of aesthetics or rust resistance needed.

Last but not least, we need to address terminal unit selection, specifically the units that are upstream of the radial diffusers supplying the bay, as that area will require its own set of airflow and temperature requirements in order to create a safe environment.

Most bays have no noise level requirements and are located within an interior zone (15' from a perimeter wall), so the terminal unit would need to only provide cooling and airflow control. The most economical and efficient product to do this would be a single duct terminal unit. Krueger offers a couple of single duct options, the most common being the LMHS, which is able to meet the necessary maximum, minimum, and turndown airflow requirements. This is not to say that a fan powered box could not be used, but the additional cost would likely outweigh any benefits over a single duct design. *(Figure 5)*

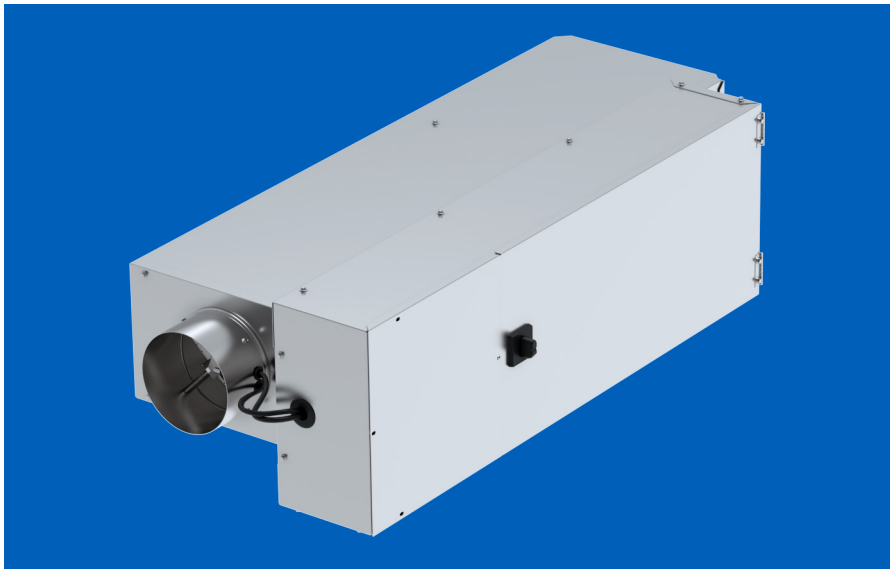

Figure 5: LMHS Single Duct Terminal Unit

In summary, when it comes to a firing range application, the specifics of the design can make or break the long-term efficiency and viability of the building. The combination of radial flow diffusers, filtered returns, and single duct terminal units will optimize the indoor air quality and thermal comfort of this application.

For design assistance or to learn more about the products mentioned, reach out to your local Krueger Representative or visit us on the web at www.krueger-hvac.com.